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ABSTRACT

The document presents a collection of articles about LSD. The first article discusses the increasingly popular use of blotter acid (tiny squares of absorbent paper soaked in liquid LSD). Article 2 furthers this look at the newer LSD formats and describes rumors of lick-'n-stick stamps and color-transfer tattoos as examples of techniques aimed at producing more attractive and more merchandisable products. Article 3 briefly compares yesterday's LSD with today's in terms of stability of dosage. Article 4 looks at researchers' attempts to learn more about calcium blocks to neutralize the effects of hallucinogens. The final article presents an overview of LSD and gives its history, chemistry and effects, therapeutic applications, overdose and adverse effects, and legal status. The document concludes with a 29-item annotated bibliography of books and articles written between 1964 and 1982. (LH)

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# Do It Now Foundation
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# LSD

SO 015 306

# L.S.D. Today:

Reprinted from
Drug Survival News

# The Comic Strip Trip

by Jim Parker

LSD's making a name for itself again in most parts of the country. And it's making a name by cashing in on the names — and faces — of a growing list of comic strip heroes and other cartoon figures.

According to drug treatment personnel and law enforcement officials we contacted around the country, use of LSD is up over recent years — and is continuing to rise.

"It's becoming more and more of a problem," Detective Wayne Burch of the Harris County (Texas) Sheriff's Department told us in a recent interview. "There for a while it died down and it seemed like no one used it, but it's back."

A spokesman for the U.S. Drug Enforcement Administration admitted that there has been an "upswing" in LSD use in recent years, adding that the revival has been especially prevalent in California and in large urban areas in the East and Midwest.

"We feel that this resurgence started on the West Coast...and to a great degree involves some of the old organizations, the old-timers, getting back into business."

But if LSD's new wave is a product of LSD's old wave — a wave that most thought had crested a dozen years ago — then there's a hole somewhere in the theory that you can't teach an old dog new tricks. Because LSD today is as different from vintage LSD in as many ways as it's similar in others.

## Smaller is Better

The subject of all the sound and fury currently swirling around LSD is blotter acid — tiny squares of absorbent paper soaked in liquid LSD. Over the past several years, blotter has emerged as *the* dominant LSD format, and for several understandable reasons.

Since newly-manufactured LSD is odorless, colorless, and tasteless, there is virtually no limit to the number of objects and substances that can be used as carriers. And although in acid's early days sugar cubes and animal crackers were favored media for delivering doses of the drug, they fell from favor over the years — in large part due to their bulk.

Tablets emerged to dominate the street acid market from the mid-sixties to the mid-seventies, but gradually gave way to increasingly small formats, particularly "windowpane" (small gelatin chips), "microdot" (tiny pellets), and blotter.

The object of the smaller-is-better mentality in LSD marketing has been strictly utiltarian: to make the drug as undetectable from prying eyes as possible.

The very minuteness of effective psychoactive doses of LSD has contributed to the small-is-beautiful ethic in LSD marketing: As little as 25 micrograms (one forty-thousandth of a gram) can produce noticeable perceptual and cognitive changes, with progressively higher dosages producing increasingly pronounced perceptual distortions and pseudohallucinations.

One key consideration that distinguishes today's LSD from the LSD of the past is potency. Most acid today is simply not as strong as the stuff that's gone before. "It used to be around 250 micrograms, but now we're getting around 50 (mcg)," Detective Rene LaPrevotte of the San Francisco Police Narcotics Unit told us in a recent interview. "So it's about one-fifth the dosage it used to be."

LaPrevotte's observation was corroborated by chemists at the U.S. Drug Enforcement Administration. According to the DEA, the average LSD content of currently available street acid ranges from 40 to 100 mcg, with an average dosage of 60 mcg. This compares with an average potency level of 150-200 mcg in LSD's heyday a decade ago according to a DEA spokesman.

Lower dosage levels may account for the increasing use of LSD, which has been reported in most parts of the country over the past year. "It's weaker now, so it produces a more manageable reaction," according to Willie Fennell, a counselor with the New York State Division of Substance Abuse Services. "You don't get that instant insanity. It's more of a recreational drug than a heavy mind-expansion thing these days."

## "Packaging Sells"

But if lighter dosage is one factor in increased LSD use around the country, another important factor is surely product packaging. Whereas only a few years ago little thought was given to the appearance of individual doses of LSD, a greater concern for the esthetics of acid has emerged over the last year or two, as manufacturers and distributors have developed a greatly increased awareness of the time-honored American art of packaging. And while this concern for appearance developed as a means of establishing "trademarks" for otherwise indistinguishable products, lately it's turned into a full-scale preoccupation on the parts of acid entrepreneurs.

Today, fairly sophisticated color-screening processes and printing technology have become an increasingly inportant part of the street acid biz, with a number of well-known cartoon characters peeking playfully off surfaces which their creators never dreamed they'd grace. Probably the single-most desirable LSD "brand" today is "Sorcerer's Apprentice," which features a full-color Mickey Mouse outfitted in wizard's garb from the film, "Fantasia," although Snoopy, Goofy, and the old blotter standby Mr. Natural each retain its own devotees. In addition, a variety of lesser-known blotter "brands" are also available, including dragons, unicorns, flying saucers, stars, and pyramids.

Fennell sees LSD's current vogue as a triumph of the new packaging techniques. "The cartoon stamps cater to a younger generation of users," he said. "It's a device to make LSD more palatable and more attractive to new users...It's packaging, and packaging sells."

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Drug Survival News

## DSN Rumor of the Month...

# L.S.D. Cult

## *Poisons Kids With Cute Lick 'N Stick Tattoos!*

During its first turn around the recreational drug circuit in the early and mid-1960s, LSD generated a fantastic mythology of horror stories concerning the dangers — real and imagined — of the drug. Nearly everyone (or so it seemed) heard or repeated one of these rumors along the way.

Remember the one about the group of acid heads who crawled up a mountain at dawn and stayed long enough to *totally blind themselves* after staring transfixed into the sun for hours? What about the kid who *pulled his own eyeballs out of their sockets* after a particularly excruciating round of hallucinations? (A variation on this theme had the kid jamming out the offending visions with the points of pencils.)

There were other stories, too. One that made the rounds for years concerned a California Highway Patrolman who ran the old heroin taste test on a cache of sugar cube LSD he discovered in the car of a pretty young girl he'd pulled over for speeding. The cop let the girl off with a warning after deciding that the sugar cubes didn't taste like any drug *he'd* ever heard of. He then got back onto his motorcycle and tooled off into the sunset, or the nearest thing to it. When the acid hit, legend has it that the state trooper *somersaulted his motorcycle over a cliff and was killed instantly.*

Justice was swift and merciless in the horror stories that accompanied LSD's emergence on the street. The only problem was that, often as not, the stories had the ring of heavy *fictionalization* — when they weren't complete fabrications altogether.

This is not to suggest that LSD hasn't caused its share of problems over the years; it *has*— more than its share, in fact. And for more than one user, the toughest, scariest, nerve-crackingest confrontation they're likely to ever experience in their lives happened when they confronted themselves in the middle of a full-blown LSD Panic.

But for years the hysteria over acid was everywhere, until it became virtually impossible for millions of users to distinguish between the real risks involved in taking the drug and the fantasies embroidered around it by rumor and myth. And this confusion surely tipped the existential balance in more than one user in favor of the Panic.

A similar type of hysteria has begun to attach itself to the current resurgence of LSD use. Probably the most popular of the new wave of LSD rumors has it that cute lick-'n-stick stamps or color-transfer tattoos are being manufactured and distributed to children — free of charge, reputedly — by dope dealers with the goal of seducing a whole new generation of potential LSD consumers.

And while, according to the best available evidence, cartoon acid is plain-old paper blotter LSD with no frills — and no stamp, no sticker, and no tattoo, either (*and*, like everything else you ever heard of, it's *never*

*(Continued on next page)*



4

Photos courtesy of *High Times*

free of charge) — newspapers around the country have played up the story, using it as one more example of the treachery to which black-hearted dope traffickers will resort to command the allegiance of new hearts and minds.

An article in the New York *Post* attributed the LSD to "a California cult composed mostly of former followers of Dr. Timothy Leary who believe in LSD use." The *Post* article dubbed the half-inch squares of blotter embossed with the figure of Mickey Mouse in sorcerer's garb from the film "Fantasia" as "stamps," and it's been off to the races ever since in the old media LSD rumor mill.

Quickly, the acid "stamps" turned into "stick-on LSD transfers," then "lick-'n-stick transfers," in news stories around the country — in spite of the fact that no one could explain *what* reason drug dealers would have for putting sticky adhesive on the backs of the blotter "stamps," especially since no one could think of any reason whatever for sticking doses of LSD to surfaces other than the roofs of mouths or the tips of tonsils.

Then the "lick-'n-stick transfers" made another transformation as newswriters across the country scoured their Thesauruses searching for new ways to describe something they'd evidently never seen. The "transfers" became "decals" in some accounts, then "tattoos." From a casual look at the daily press, there was no apparent end to the lengths to which LSD merchants would go to merchandise their products to our nation's kiddies.

And make no mistake about it, dope dealers *will* go out of their way to lure a potential convert into the fold, but according to most legitimate authorities, there's no way they're doing half the devilish things suggested in the daily press — at least not the things that end up costing them money. And giving drugs away ends up costing them money.

"I've never known of anyone trying to pass it off to kids," Lexington, Kentucky police Detective Fran Root recently explained to Louisville *Times* staff writer Bob Deitel, who explored the origins of the rumor. "For one thing, it costs money."

A cop in Cleveland echoed Root's assessment: "Very few drug dealers give anything away."

Harumph. Okay, so where does that leave our Rumor?

Alive and kicking. A rumor that seems to have originated in Colorado began to circulate concerning a man in a clown suit who supposedly appeared one day on a street corner in a Denver suburb and began handing out "stamps" (or "tattoos" — no one was really sure which) to passing schoolchildren. "Supposedly, he was just giving it away," Denver Police Lt. Robert Moravek told Deitel.

This new variation had even more of the flavor and consistency of Myth than the old Rumor and quickly acheived wide dispersal throughout the Rocky Mountain states, the Great Plains, and Midwest.

It even spread to Rawlins, Wyoming (courtesy of a Colorado-produced flyer that was circulated in schools and posted at the local police department, which warned of the availability of the "stamps"). None turned up in Rawlins, but Rawlins police told Deitel that they'd heard that some *had* been found in Riverton, some 200 miles away.

As far as we know, nobody bothered to check in Riverton, but we'll lay odds that if they *had*, they would've heard something from someone who had heard something about a man in a clown suit handing out LSD samples to passing schoolchildren.

That's the way Rumors work.

*—Jim Parker*

*Reprinted from* ***Drug Survival News,*** *Vol. 10 No. 2 (September-October 1981) page 18*

# LSD: Yesterday and Today

LSD has been making a strong comeback in the 1980s — although many would argue it never really went away. Blotter acid is achieving new popularity across the nation in a colorful new format that is sometimes referred to as LSD "stamps." A few of the samples reported in the analysis chart fall under this category, including red blotter imprinted with a black star, black blotter with a six-pointed star printed on both sides (from San Diego) and a transparent green triangle blotter from New York.

*High Times* discussed the new wave of LSD technology and marketing in an August, 1981 article titled, "LSD 81— Marketing the Better Blotter." The article described the great lengths acid entrepreneurs go to in order to make individual products distinctive or unique. Silk screening and complex color-printing methods are among the new techniques being used to produce a more attractive — and more merchandisable — product.

However, quality control isn't all it could be. Of the two black star samples reported in this issue, one was found to contain LSD while the second tested as containing no drug at all.

Consistency of dosage is apparently also a still-imperfect science, with the amount of acid applied to blotter paper subject to considerable variance. According to *High Times*, the average dose today fluctuates between 50 and 90 micrograms. This represents a fairly low dosage level compared to street acid sold in the middle and late-sixties. And while LSD tested in analysis labs over the past three years has consistently maintained a validity rate of 80 to 90 percent—a very high rate compared to other street drugs—the unknown remains very much a factor in the LSD experience. And the unknown, in the form of unpredictable and unstable dosages, will probably continue as a major component of the street acid scene in the foreseeable future.

**Street Drugs Analysis All U.S.**

**April–July 1981**

**Actual Contents (main ingredients)**

**Purported Contents**

| Purported Contents | Amphetamine | Methamphetamine | Caffeine | Ephedrine | Caff. & Ephedrine | Pseudoephedrine | PFA, Caffeine, Ephedrine Combos | Diet Pills | Asthma Meds & Antihistamines | Barbiturate | Methaqualone | Misc. Tranquilizers | Diazepam (Valium) | Cocaine | Coke & Lidocaine + Mannitol | & Misc. Pharms | Additives Only | LSD | Positive THC | PCP | Heroin & Adulterants | MDA & MDM | Mescaline | Psilocybin | Corticosteroids & Arthritis Meds | Unidentified | No Drugs | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amphetamine | 1 | 2 | | 3 | 1 | | 12 | | | | | | | | | | | | | | | | | | | | | 21 |
| Methamphetamine | | 17 | | 3 | | | | | | | | | | | | | | | | | | | | | | | | 22 |
| Speed/Uppers | | 3 | 2 | 4 | 1 | | 16 | 1 | | | | | 1 | | | | | | | | | | | | | | | 40 |
| Downers | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Methaqualone | | | | | | | | | 10 | | 17 | | 1 | | | | | | | | | | | | | 3 | | 34 |
| Cocaine | | | | | | | | | | 1 | | | 1 | 61 | 14 | 21 | 35 | 11 | | | | | | | | | | 164 |
| Heroin | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | 1 | 4 |
| LSD | | | | | | | | | | | | | | | | | | 7 | | | | | | | | | 3 | 10 |
| Barbiturate | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Marijuana/Hash | | | | | | | | | | | | | | | | | | | * | | | | | | | | 1 | 9 |
| PCP | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | 1 | 2 |
| Angel Dust/THC | | | | | | | | | | | | | | | | | | | 4 | 1 | | | | | | | 1 | 6 |
| MDA & MDM | | | | | | | | | | | | | | | | | | | | | | 8 | | | | | | 8 |
| Mescaline | | | | | | | | | | | | | | 1 | | | | | | | | | 1 | | | | | 2 |
| Psilocybin | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | 1 |
| Arthritis Meds | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | 14 | | | 16 |
| Asthma Meds | | | | | | | | | | | | 1 | | | | | | | | | | | | | 2 | | | 3 |
| Diet Pills | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | 1 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unknown | 2 | 8 | 3 | 4 | | | 20 | | 3 | 1 | 3 | | 2 | 1 | | 5 | 10 | 12 | 2 | 7 | | 1 | | | | 13 | 7 | 17 | 132 |
| **Totals** | 3 | 30 | 7 | 18 | 2 | | 32 | 1 | 18 | 1 | 22 | 1 | 8 | 63 | 14 | 26 | 67 | 23 | 8 | 19 | 2 | 9 | 1 | 1 | 1 | 28 | 10 | 25 | 465 |

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# Calcium Blockers Proposed as Hallucinogen Treatment

NEW YORK — Researchers in New York believe they have discovered how hallucinogens such as LSD, PCP and mescaline work — and how their actions might be reversed.

The researchers, Burton and Bella Altura of the Downstate Medical Center in Brooklyn, hypothesize that arterial contractions in brain tissue may result in the perceptual and cognitive distortions produced by hallucinogenic drugs.

The researchers believe that the drugs' effects are caused by a reduced flow of blood to tissue, resulting from the contractions.

"The LSD and the mescaline appear to cause a spasm which gradually subsides or goes to a lesser spasm" Burton Altura explained.

The Alturas also believe that calcium channel blockers, which inhibit the flow of calcium into muscle cells, may reduce or reverse the effects of hallucinogens by blocking arterial contractions within the brain.

"No muscle cell can contract without a certain amount of calcium inside," Altura told *Drug Survival News*. "including those that line the walls of the blood vessels. If you prevent access of calcium to the interior of the muscle cells ... the vessels cannot contract."

The researchers are currently testing the ability of the blockers to neutralize the effects of hallucinogens. Altura stresses there is no evidence as yet that blockers can undo long-term damage, or "burnout" caused by hallucinogens.

Altura, whose studies involved arterial tissue taken from the brains of dogs, cautioned against over-generalization of his findings



6

# PharmAlert

Student Committee on Drug Abuse Education
University of Maryland at Baltimore
School of Pharmacy

Volume 11, Number 1 December, 1979

## LSD: AN OVERVIEW

*Alan Lyles*

### HISTORY

D-lysergic acid diethylamide (LSD) use has, in recent years, been declining[1]; however, numerous well documented and highly publicized reports of adverse reactions to phencyclidine (PCP) may be leading to a revival of its popularity. Support for its resurgence as a drug of choice is given by data from PharmChem Research Foundation which ranks LSD among the top three most popular drugs (only trailing cocaine and amphetamines)[2]. This statistic, however, obviously overlooks the widespread use of alcohol, marijuana, nicotine and caffeine.

Although the availability and use of LSD for the psychedelic experience is a relatively recent phenomenon, the use of naturally occurring chemical analogs to LSD can be traced back to the Aztecs. Hundreds of thousands of plant species have been identified but only about sixty possess hallucinogenic properties[3]. One of these, ololiuqui, a species of morning glory seed, was in use by Central and South Americans at the time of the Spanish Conquest. It was felt that this plant had mystical healing properties. Chemical analysis of ololiqui reveals that the active ingredient is d-lysergic acide amide. Although having only about one-tenth the potency of LSD, ololiqui was still sufficiently hallucinogenic to be regarded by the Indians as a sacred plant[4].

Use of morning glory seeds for their consciousness-altering powers was apparently unknown to the people of the Old World; however, they too used naturally occurring lysergic acid for medicinal purposes. Ergot, or *Claviceps purpurea*, is a naturally occurring fungus which contains lysergic acid. As early as 1582 it was recognized that ergot is effective in ameliorating uterine pains and as an oxytocic. The history of ergot is laden with superstition and fear because of its poisonous properties: it is capable of causing convulsions, gangrene, loss of limbs and death – and for those who survive the poisoning, there remains a lasting defect in mental competence[5].

D-LSD, known variously as "acid," "purple haze," "orange sunshine," "window pane," "Mr. Natural," "invert acid," "red shield," and "purple bull's eye"[6], was first synthesized in 1938 by Albert Hoffman. At the time, Hoffman was employed as a research chemist for the Sandoz Pharmaceutical Laboratories in Basel, Switzerland. Hoffman was engaged in the preparation and analysis of a series of ergot derivatives, of which lysergic acid diethylamide was merely one. (The fact that lysergic acid diethylamide was number twenty-five in the sequence of compounds being analyzed is responsible for its also being known as LSD-25.) The true significance of this new compound lay masked for five years while it sat on the shelf. However, in 1943, Hoffman inadvertantly self-adminsitered a dose of LSD via percutaneous absorption. His account of the experience is that "my field of vision swayed before me like the reflections in an amusement mirror. Occasionally, I felt as if I were out of my body."[7] The first experience may have been accidental, but Hoffman must have found it worthwhile since he has reported using LSD as recent as 1970.[8] The newly discovered drug languished for over seven years until the Central Intelligence Agency of the United States decided to explore its possible uses.[9] The methods and conclusions of this research have been reported at great lengths elsewhere and will not be dealt with in this paper.

While the CIA was doing its testing, the American public was doing some testing of its own. Under the tutelage of Timothy Leary, a whole generation of Americans was invited to "turn on, tune in and drop out." If LSD did not represent a common, shared experience for this generation, it did symbolize the primary value placed on experience over reason that characterized the 1960's. Leary and the gurus of the psychedelic experience praised LSD as the agent which could put the user into contact with the forces of the universe with a transcendent knowledge of self. It is against this philosophical context that the practical reality of reports of uncontrolled psychotic flashbacks and bad trips (based on impure products hustled by unethical promoters?) clashed.

During this time, published studies suggested a danger of chromosomal damage with resultant genetic defects that could arise from LSD[10,11]. Many reports are flatly contradictory about LSD's potential mutagenicty; however, a recently published study using modern analytical techniques indicates that LSD is not mutagenic[12].

Current use of LSD seems to reflect a balanced awareness of the "opportunities" of the LSD experience with some legitimate concerns about the safety of its use.

### CHEMISTRY AND EFFECTS

Synthesis of LSD is initiated by extracting D-(+)-lysergic acid from ergot, using aqueous alkali.[13] The reaction sequence, determined by Garbrecht, is rapid – it takes approximately thirty minutes, does not require expensive apparatus or chemicals, and proceeds with a good yield at room temperature.[14] The ease of synthesis and availability of LSD is supported by PharmChem Research Foundation's data on analysis of street samples purported to be LSD, mescaline or psilocybin for the period of January February, 1972-1978.[2] For all samples in which the alleged content was LSD the actual content was LSD: however, 69% of the "mescaline" and "psilocybin" samples were, in fact, LSD.[2]

LSD contains two asymmetric centers and consequently exists as four isomers. Nevertheless, only the D-isomer has hallucinogenic activity. Investigations with chemical analogs of D-LSD have shown that it contains the optimum substituent groups for psychotropic activity. Taking D-LSD as the standard, the monoethylamide, dimethylamide and the free amide of D-LSD each have approximately ten percent of its potency[15].

To an extent that far overshadows other drugs of abuse, the outcome of LSD use is dramatically set and setting dependent. The expectation of the user, the milieu in which it is taken, as well as the purity of the drug obtained all combine in a unique manner to determine each person's experience with LSD.

Broadly categorized, there are two components to the reactions experienced with LSD: subjective and objective. Subjective effects variously include altered time perception, visual "hallucinations," loss of a sense of boundary within the environment, labile mood and, occasionally, a sense of detachment. Objective effects may include any or all of the following: anorexia, nausea, elevated blood pressure, dizziness, weakness, mydriasis and muscular incoordination[16]. Massive overdoses may be manifested by hyperactivity, psychosis, writhing movements, diarrhea, respiratory distress and coma[17].

Orally administered LSD is well absorbed and distributed to most body tissues, but only minute quantities of the dose cross the blood-brain barrier. The dose of LSD required for psychological response is not well defined and has been reported to be as little as 25 mcg to as much as 1,000 mcg[4]. From a pure sample the average adult will achieve an optimum response in the dosage range of 100 – 200 mcg. In man, intravenously administered LSD has a half-life of 175 minutes[18], while an orally administered dose may have a duration of eight hours or more. Tolerance to the drug develops rapidly but is short lived. For a period lasting approximately two to three days the effects of the drug cannot be reliably repeated with subsequent ingestions[19]. The establishment and elimination of tolerance with LSD is unusual in that there have been no reported withdrawal symptoms per se[20].

The exact mechanism of action of LSD, including its specific neurochemical basis, has yet to be satisfactorily elucidated. As Morgane and Stern state, "attempts to relate complex cognitive behaviors of an organism to chemospecific systems and transmitters in the brain is not yet possible, although many basic behavior patterns can be selectively manipulated and linked with the operation of their neural systems"[21]. Much of the difficulty in establishing the biochemical basis for the effects of LSD resides in the subjective nature of the experience being investigated. Ordinarily this would make matters complex enough; however, aside from some clandestine research work on humans, most researchers have used laboratory animals. Consequently, the proposed theories are quite speculative and of necessity, incomplete.

One theory states that LSD, being structurally similar to the neurotransmitter serotonin (5-HT), exerts its effects by competition with 5-HT for binding sites. Support for this idea of competition is given both by the structural similarity between 5-HT and LSD and by the fact that there is sterospecificity involved in binding with the serotonin receptor. Binding is so specific that D-LSD binds 1,000 times stronger than its psychologically inactive isomer[22]. Brain stem raphé nuclei utilize serotonin as an impulse transmitter. Anatomically, the raphé have projections into the forebrain and hypothalamus[21], areas which have been associated with reward and punishment. Functionally, "the entire limbic forebrain system . . . receives and integrates sensory inputs from all the sensory systems . . . and refluxes information into the entire hypothalmanic and lower reticular fields"[21]. Other investigators have found that administration of LSD results in reduced firing of the neurons in the raphé nuclei and a lowering of 5-HT turnover[19]. Considering the anatomical position and role of the raphe nuclei, it is tempting to conclude that any alterations in impulse transmission in this area will result in altered perceptions and behavior. Nevertheless, this theory has yet to be firmly substantiated and, in at least one recent study, the correlation between decreased 5-HT turnover and hallucinogenic activity has been seriously questioned[23].

Another potential site of action for LSD is the hippocampus. Its function is at present ill defined, but, at a minimum, it can be said to be important in directing attention[24]. It has been noted that both D-LSD and lesions in the hippocampus can result in perseveration as well as interruption of certain types of habituation[25]. There is experimental support for the concept that transmission of impulse in the hippocampus is regulated in normal functioning by histamine, specifically via action on H2 receptors. Green et al have demonstrated that D-LSD may interfere with the binding in these H2 receptors, thereby allowing these histaminergic fibers of the hippocampus to fire[25]. Although this does not fully explain the nature of the hallucinogenic effects of LSD, it does offer an explanation of some of the less prominent actions of the drug, e.g., perseverance.

Another proposed mechanism for LSD is that it heightens the sensitivity of the brain to sensory inputs without lowering the threshold for excitation[18]. There seems to be little research to support this proposition and it does not appear to have gained acceptance.

## THERAPEUTIC APPLICATIONS

LSD has been used in psychotherapy for decreasing the duration of therpay, increasing the receptivity of the patient to therapy and enabling the patient to be more open and receptive to dealing with his problem[4]. However, a five year study by Barker and Buck using LSD in a maximum security mental hospital failed to document that LSD had any value in therapy other than improving patient morale[26].

LSD has been shown to be of some benefit in treating autistic children, but the improvement quickly reverses on discontinuance of the drug[4]. Similarly, attempts at treating chronic alcoholism with LSD have not met with long term success – and in those cases which have resulted in abstinence, LSD has been only minimally causitive[27].

Erick Kast administered LSD to cancer patients in the Cook County Hospital in an attempt to augment the effect of other analgesics[27]. Kast found that it was effective in reducing pain and that the analgesic effect extended beyond the hallucinatory episode. When the patients' pain returned, they reported that it did not seem as significant as previously. In analyzing the validity of these reports, it is important to consider the role of autosuggestion and LSD's property of increasing suggestibility; therefore, it is possible that this may be predominantly a placebo effect.

Positive responses have been reported in the use of sub-hallucinogenic doses of LSD for the treatment of phantom limb pain[27]. However, this resulted not from its use in conjunction with psychotherapy, but solely from its action to increase brain levels of 5-HT[28].

## OVERDOSE AND ADVERSE EFFECTS

Consequences of the ingestion of an excessive amount of LSD vary widely among individuals however, some constant features of the condition are nausea, anorexia, elevated blood pressure, dizziness and mydriasis[16]. The variable features of the adverse LSD experience are not always directly attributable to an overdose of the drug. Anxiety, panic reactions, a feeling of loss of control and morbid "hallucinations" are more often a direct extension of the action of the drug than a consequence of overdose. Heightened suggestibility[16] and intensified emotional responses during LSD use may exacerbate any pre-existing depression, confusion and/or uncertainty[16].

To date there have been no clinical reports which conclusively identify excessive intake of LSD as a direct cause of death. However Griggs has reported on the autopsy of a 34 year old male for whom the only abnormal anatomical finding was a high serum level of LSD[29]. Griggs reported that no other drugs were detectable in the body. It was further determined by Griggs that the man had taken twenty-three times what had been extrapolated to be the lethal human dose (i.e., he took the equivalent of 320 mg I.V.).

Also reported in the literature are eight cases from the emergency room of the San Francisco General Hospital. These patients has taken LSD intranasally in amounts that far exceeded the normal oral dose for hallucinogenic effect on the misunderstanding that the substance was cocaine[17]. All the patients were reported to have "manifestations of psychoses, hyperexcitability, tachycardia, mydriasis and hypothermia" as well as apnea, and some had generalized bleeding. Several of the patients were in such a severe state that they required endotrachial intubation, as well as mechanical respiratory assistance. The crisis period lasted no more than twelve hours for the most severe case, and all of the patients had left the hospital within 48 hours.

The nature of adverse reactions to LSD as well as their clinical management are well summarized in the HEW publication "Treatment Manual for Acute Drug Abuse Emergencies"[1]

When dealing with confused, disoriented, anxious or hallucinating persons, first ascertain that the condition is in fact a manifestation of LSD or another psychotropic agent. The signs and symptoms can easily be confused with a genuine psychosis, with diabetic coma, or with any number of other non-drug-induced conditions[1]. At a level of severity below that of the cases reported above, one would most commonly encounter two distinct categories of untoward reactions: the panic reaction and the flashback reaction[1].

The panic reation can best be understood in terms of an individual's particular response to the normal actions of the drug. In brief, ingestion of LSD leads to altered sensory perceptions ("hallucinations"), tachycardia, dilations of the pupils and rapid pulse rate, all of which can combine to give the user a sense of loss of control of his situation. This feeling of loss of control may be greatly intensified by the actions of the drug; consequently, the user may manifest acute panic and anxiety reactions. This condition, in some cases, can be distinguished from amphetamine psychosis due to the stronger sympathomimetic effects of LSD and the clinical signs characteristic of the amphetamine user: malnourishment, insomnia and, frequently, the presence of needle marks. Also the nature of the psychedelic experience with LSD is more visual whereas amphetamine-induced hallucinations are primarily auditory. A further distinction between the two conditions is that the LSD user is generally aware that he is "hallucinating"; however, a patient suffering from amphetamine psychosis will be unable to distinguish his hallucinations from reality. Finally, urinalysis may be performed to confirm the presence of amphetamines for a period of up to seventy-two hours subsequent to drug use.

Patients who have used belladonna alkoloids may have features comparable to that of the LSD users, but a differential assessment can be made on the basis of an examination for the classic signs of belladonna poisoning: "hot, blind, dry, red, mad" (i.e., hyperthermia, dilated pupils which may not react to light, dry skin, flushed appearance and hallucinations). Also, an oral history taken from the user or his friends can shed light on which substance might have been used.

Ungerleider and Frank suggest that the treatment for acute panic reactions should be primarily aimed at relieving the patient's anxiety[1]. The treatment environment should be neutral, comfortable and absent from disturbing outside stimuli. In addition, it should be staffed by persons who are relaxed and competent in dealing with anxious and/or psychotic patients. It is further suggested that the patient should be allowed to talk through his fears and do "reality testing" with the counselor. From time to time the counselor may want to give factual information to orient the patient as to where he is, what the day is, etc.. Furthermore, the counselor should reassure the patient that he is not "losing his mind," that the reactions are normal, and that he should relax. It is critical that the patient not be left alone at this time due to the potential for self harm. Also it is advised that physically restraining the patient be reserved until all other options are exhausted, since this intensifies his already uncontrollable anxiety[1].

In certain situations of acute anxiety, medication may be advisable. Due to the uncertain nature of the substances taken in illicit drug use, medications should be given judiciously and only when there is a vasopressor available to counteract a potential hypotensive crisis arising from interaction with drugs previously taken[1]. Diazepam is the agent of choice and is given in the dose range of 0.1 mg/kg or 10 mg orally in adults repeated every hour or so as necessary.

As in all psychological trauma, it is advisable that a thorough psychiatric examination and evaluation be given as soon as feasible after the crisis has subsided. Subsequent treatment will be determined at this time and can vary considerably depending on the nature of the individual patient.

Another major category of adverse reactions to LSD is the "flashback."[1] A flashback is a spontaneous, non-volitional recurrence of the hallucinatory state weeks, months, even years after the initial experience with the drug. The spontaneous recurrence of alterations in visual perception apperas to correlate with the cummulative amount of LSD taken over time, but may occur with a single use of LSD. It has been estimated that flashbacks, ranging from very mild to severe, occur in approximately 5% of LSD users although the incidence of severe reactions and psychoses is considerably less.

Although flashbacks do occur in the absence of any identifiable causative agent, the experience may generally be precipitated by "marijuana, secobarbital, fatigue or stress" and, rarely, alcohol intoxication[30]. Flashbacks tend to be of short duration and of decreasing intensity with recurring episodes. For the experienced drug users, the flashback generally does not represent a particularly disturbing experience, but may be viewed as an unexpected bonus. The inexperienced or occasional user may be incompetent to deal with this sudden, unexpected loss of control of sensory input and volitional activity. As a result these individuals may be thrown into a panic reaction, with its attendant anxiety and psychosis, as described above. Of the cases involving flashbacks which are seen clinically, many center on unresolved problems, repressed fears or freightening experiences. Horowitz has reported that flashbacks of this nature cease when appropriate psychotherapy has been employed to correct the underlying psychological problem[30].

Ex-LSD users surveyed in the Boston metropolitan area expressed a common theme that LSD use began in a climate of individual role uncertainty and a search for meaning in life (although LSD use was not implicated as either causing or as resulting from that uncertainty). Further, they reported that

hallucinogenic drug use tended to compound or augment pre-existing problems. Taken as a group, these "ex-users" reported that resolution of conflicts, problems and "achievement of meaning" tied in closely with discontinuance of the use of drugs[31]; however, the sample size of the study reported is too small to infer valid generalizations.

## LEGAL STATUS OF LSD

The laws and regulations governing the prohibition of LSD are included in the Comprehensive Drug Abuse Prevention and Control Act of 1970, which became law in 1971. LSD is included in Schedule 1, which means that it is considered to have a high potential for abuse and that there is no generally recognized and accepted medical rationale for its use[32].

Penalties prescribed for the possession, manufacture, or distribution of a Schedule 1 substance (drug) are variable depending on whether it is a first offense and depending on the age of the person to whom the substance is sold. The sale of LSD to persons under 21 years of age is dealt with more stringently than its sale in general in that the maximum amounts for imprisonment, fine and parole may be greater.

It should be noted that penalties provided for in the Comprehensive Drug Abuse Prevention Act are in addition to any other fines or penalties which may be authorized by federal, state or local governmental authorities[33]. Nevertheless, the high yield, low cost, microdosing properties of LSD make it an almost irresistable item of trade for the illicit entrepreneur. There is no comparable organization to NORML advocating the legailization or reduction in the severity of penalties for possession of LSD; therefore, it is probable that the existing laws and penalties will remain for the foreseeable future.

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